

DIGITAL LEARNING INNOVATIONS FOR SYRIAN REFUGEES AND HOST COMMUNITIES EXTERNAL EVALUATION REPORT

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Digital Learning Innovations

External Evaluation

Project Report

November, 2018

Executive Summary

This report presents the key findings of the Digital Learning Innovations project implemented by the International Education Association (IEA) to test the potential of technological and pedagogical innovations to improve the quality and accessibility of learning in and outside the classroom for Syrian refugee children and host communities in Lebanon and Jordan, with a primary focus on children ages 14 to 18. The project had two components, the first was implemented in Lebanon at 41 schools and led by IEA, and the second was implemented in Jordan at 14 UNICEF-affiliated Makani centres and led by Birzeit University.

As part of the external evaluation process, the external evaluation expert conducted two field visits to Jordan (Amman and Abu Nusair) and Lebanon (Beirut and Beqaa). The expert interviewed key project staff members, and several beneficiaries (students, teachers and principals) to assess the project implementation and the extent to which it achieved its goals and objectives. The project materials and data, including focus group scripts (4 pre-intervention and 3 post-intervention focus groups, and assessment of learning outcomes were conducted as part of the Lebanon component) interviews, observations, questionnaires and reports, were analyzed as part of this evaluation.

For the Lebanon component, the project was largely successful in achieving its stated objectives and affecting the desired change. This impact and change were only limited by the project's scope and available resources. The project reached 61 teachers and 1,420 students in the 41 participating schools, spread over 5 geographic areas in Lebanon (Beirut, North, South, Beqaa and Mount Lebanon). Key to the project objectives was the development of an "Ecology of Digital Educational Tools and Resources". In Lebanon, this was achieved in the form of the Coder-Maker Digital Innovations Kit (CMDI Kit), an integrated set of pedagogical principles, hardware and software components, training materials, events, engagement model and digital support tools specifically designed to enable schools and educators to provide an effective learning experience within the challenges of the post-crisis and refugee situation in the host communities.

To inform the design of the CMDI Kit, the project identified several challenges in the provision of education in post-crisis and refugee situations. These challenges include the prevalence of violence among students, increased administrative and managerial burden, the refugee students' struggle to adapt to a different learning environment, the conflict between learning and earning as most refugee students favoured working to earn a supporting income for their families rather than focus on their study, weaknesses in teacher skills to deliver engaging and effective learning, and remarkably high dropout rates.

The CMDI Kit was intended to support schools and educators in addressing this diverse set of challenges, and hence it was purposefully designed following a holistic approach that integrates the pedagogical and technological processes. The project outcomes demonstrate that this approach was instrumental in stimulating interest of teachers and students beyond the initial attractiveness of technology gadgets, and well into learning and scientific curiosity. It is important to note that this holistic approach is in stark contrast to the current situation in schools where technology projects are confined to a weekly one hour extra-curricular activity that has little connection to the national curriculum.

The project provided evidence that by embracing a holistic, pedagogically sound approach to designing and developing the CMDI Kit, transformative learning experiences were created and stimulated motivation to teach and learn, strengthen teachers' capacities and result in more social cohesion, commitment of students to learning, more autonomy and self-organization, grit and self-confidence, awareness and more informed decisions towards career choices. These skills, traits and competencies are

the foundational building blocks to build future careers in a job market that is undergoing a fundamental transformation resulting from ever increasing technological change. While it is impossible to predict how the future job market will look like, and what jobs and careers it may create, children who are equipped with grit, resilience and a desire for lifelong learning, and those who have wider horizons, will certainly have an advantage in the uncertain, most probably even unrecognizable future.

As mentioned earlier, the project impact was inevitably limited by the available resources. Maximizing the project impact to reach the millions of refugee students in host communities necessarily mandates an assessment of the scalability and replicability of the project approach. Assessment of the cost aspect of the CMDI Kit indicates careful consideration of all kit elements to minimize cost and support scalability. For example, the kit uses low cost, commodity hardware components and open source software packages to keep the price of each kit as low as possible. The teacher capacity building component was also designed to be easily scalable and replicable, requiring no more than 6 training days spanning over a full academic year. This constrained design responds to the challenge of teacher commitment by reducing the burden and required effort. Finally, to provide continuous support, the CMDI Kit includes an online collaboration space to access tutorials and applications, share training and project materials, ask and respond to questions and get support.

Due to the long term nature of educational and learning interventions, the assessment of the project outcomes was necessarily limited to what can be measured and assessed within the relatively short project timespan. Further validation of the findings and assessment of impact should be carried out over the long term to evaluate the persistence of the observed changes, the corresponding impact on students' academic achievement, and their later progression in their life and career. To reliably establish links between this long term impact and the project intervention, the longitudinal assessment must observe control groups within similar environments and compare changes on the impact dimensions between the control and treatment groups.

For the Jordan component, the project was initially planned to develop and test technology-supported educational tools and resources in the form of experiential learning objects (xLOBs) in several Makani centres across Amman. However, the needs assessment exercise at the start of the project indicated severe weakness in the facilitators' ability to deal with technology. So the project's team decided to focus the intervention on providing pedagogical support and capability building to empower facilitators, and on developing low cost, high quality educational objects.

The Jordan component consisted of two parallel tracks: one focused on science and math and one on career guidance. The needs assessment exercise revealed several challenges faced by the educational system and Makani centres in Jordan, including high dropout rates among refugee students, gap years endured by refugees outside the classroom, ineffective or disruptive use of technology in classrooms, lack of integration and focus on life and interpersonal skills in the school curriculum, widespread violence among children, lack of qualification and capacity building opportunities for teachers and facilitators, and the tendency among refugee children to favour work over attending school.

Based on the findings of the needs assessment exercise and the understanding of the target context, the project team designed the framework and approach for both the science and math and career guidance tracks. In total, 65 xLOBs in science and math and 30 xLOBs in career guidance were designed and developed. The project included a capacity development program for facilitators to develop their competence in using the xLOBs in the educational process. 28 science and math and 18 career guidance facilitators from 11 Makani centres participated in the capacity development program.

During implementation, the project team conducted several pedagogical support sessions for the facilitators to assist them in implanting the xLOBs. The support sessions included 2 math, 2 science and 3 career guidance classes.

Overall, the project outcomes indicate general acceptance among facilitators and students of xLOBs as an innovative learner-centric approach that holds potential to improve instruction and learning. Features that were particularly commended by facilitators included the xLOBs' integration of several dimensions of knowledge, focus on life skills (such as collaboration, team work and planning) and the inclusion a variety of activities and exercises to choose from based on the classroom's context.

On the other hand, areas that can be improved include designing the xLOBs' content to be more appropriate for its target age group, and ensuring that the xLOBs content and activities are aligned with the available classroom time and can be completed within the classroom sessions.

Students who received instruction through xLOBs reported that this new approach was fun and enjoyable, and enabled them to understand the content better and faster. They also appreciated the relevance of the xLOBs activities to their daily lives and surrounding environment, and the team-based and peer learning design of these activities. Students did not, however, report a significant change in the facilitator's approach during their delivery.

Key findings and recommendations to achieve the full potential of xLOBs in transforming learning at scale include revising the xLOBs' design to better match their content and activities with their target age groups, allow higher flexibility for facilitators to adapt the xLOBs, clarify activities in the xLOBs, reduce the time required for each xLOB, develop xLOBs for younger learners, and align the xLOBs with the official curriculum.

By considering the findings of the DLI project, a clear opportunity emerges to expand the research to include a longitudinal study of each program including control groups in each model and have evidence-based research of models of digital learning innovations. It is strongly recommended that follow up work and scale up activities that use the resources, materials and content developed by the project and focus on sustainable growth to further compound the benefits and accelerate scaling.

Finally, to support project scaling, the following policy recommendations were developed based on the project's interventions and findings:

- Integrate computational thinking in the school curriculum
- Adopt innovative digitally-assisted projects as an integral component within the school environment
- Leverage DLI's approach to increase student interest in learning and reduce dropout rates
- Use DLI's approach in using technology to address the capacity challenge resulting from the refugee crisis
- Reduce the bureaucratic burden to empower principals to make decisions
- Develop innovative, digitally assisted projects addressed to girls
- Leverage DLI's approach to help students make better informed career choices

1. Project Background and Context

Since the start of the Syrian crisis, Lebanon has become the home of 1.5 million refugees, half of which are school age children under 18 years. Despite all the efforts exerted so far, it is estimated that only half of those children are enrolled in schools (United Nations High Commissioner for Refugees, 2016¹). The burden on the Lebanese schools has weakened its already fragile education system which itself needed reform (RACE II report).

Innovative digital technology projects are often sought to address educational crises and leverage the potential afforded by technology to provide learning to the millions of refugees. A stocktaking of innovative projects was conducted by *Education Global Practice MENA* with a report demonstrating various uses of technologies in educational crises highlighting the “*significant lack of evidence on the effectiveness of ICT in refugee education and although a number of studies have shown some effectiveness, they cannot yet constitute a robust body of knowledge*” (Lewis and Thacker 2016).

The Digital Learning Innovations (DLI) is a project designed to identify educational challenges for refugees in host communities and develop and test digital learning innovations to help educators address these challenges. The project was funded by IDRC and Ford Foundation in Lebanon and Jordan targeting Syrian refugees and host communities. The project is run in close partnership between International Education Association (IEA) and Birzeit University (BZU), IEA being the lead organization and BZU being a Sub-Grantee and implementing partner in Jordan. The project aims at using technological and pedagogical innovations to improve the quality and accessibility of learning in and outside the classroom for Syrian refugee children and host communities in Lebanon and Jordan, with a primary focus on children aged 14 to 18.

Within the scope of the DLI project, IEA, in close partnership with BZU, collaborated with UNICEF to implement the digital learning innovations project in 10-14 Makani Centers in Jordan, targeting approximately 50 children in each Center (at least half of whom are girls). Syrian refugees constitute 50% of the targeted children; the rest are marginalized children from the host community (Jordanian and other nationalities). The collaboration covered the following two areas: Learning Support Services (LSS) and Career Guidance to be integrated within the Life-Skills program.

In Lebanon, within the scope of DLI, IEA and its partner Fondation Mouna Bustros (FMB) worked in close collaboration with the Ministry of Education and Higher Education in twenty-one schools, targeting refugees learning with underserved Lebanese students in morning shift schools. Additional funding from Ford Foundation contributed to increase the scope of the project to an additional twenty underserved Lebanese schools which benefited from equipment secured by FMB.

2. Project Objectives and Research Questions

The project’s overall objective was to improve the quality and accessibility of learning for refugees and host communities in and outside the classroom in Lebanon and Jordan using digital innovations.

The project aimed to attain this objective by achieving the following goals:

¹ United Nations High Commissioner for Refugees. 2016. *Education Quarter 1 Dashboard*. Beirut: UNHCR.

1. Develop and test an “Ecology of Digital Educational Tools and Resources” in Lebanon and Jordan to effectively address the education challenges proper to the contexts of the host countries and those caused by the influx of Syrian refugees;
2. Provide an effective, low-cost model designed to build the capacities of teachers, educators and administrators and counsellor;
3. Deepen our understanding of the relevance and effectiveness of different digital learning innovations in post-emergency situations;
4. Inform digital learning innovation-related educational policy making and action at national and sub-national levels in Lebanon and Jordan;
5. Help students transition to higher education and career.

The research component of the project aims to answer the following questions that stem directly from the project’s overall objective and goals:

1. What are the challenges in delivering effective, accessible education for refugee children in host communities?
2. What impact does innovations in digital learning have on improving the educational process, particularly in post-emergency situations?
3. How can digital learning innovations be leveraged to deliver effective, high quality education at scale and with reasonable costs?
4. What policies and regulations must be adapted/adopted to support the implementation of these learning innovations?
5. How can digital learning innovations be leveraged to help students transition to higher education and career?

3. Lebanon Project Component

3.1. Project Impact

The project was implemented in forty-one schools, spread across 5 locations. In total, the project impacted 61 educators and 1,470 students. Beneficiaries include school principals, teachers, parents and all students of the same school. All teachers who started and completed the program plan sustained their involvement and continued implementing the project methodology.

“The program is beneficial to the teacher and to the school but for me the most important thing is the impact on students, I gained them. This project gives important skills, to all, teachers, students, the whole school. It needs to be formalised by the ministry” School Principal

3.2. Methodology

To assess the achievement of the project’s objective and goals, and to extract findings and lessons learned to support further research and scaling of the project, the following research methods were used:

- Pre-intervention focus groups with principals and teachers and post-intervention focus groups with teachers and trainers
- In-depth semi-structured interviews with principals, teachers, students in nine schools, mid-way and post the implementation
- Observations throughout the intervention’s workshops and working sessions
- Questionnaires to teachers and students
- Assessment of students’ projects (rubric)

3.3. Project Implementation

3.3.1. Selection of Schools

In Lebanon, the intervention ran in morning shift schools which were selected in close collaboration with MEHE, Ministry of Education and Higher Education and DOPS, Department d'Orientation Pédagogique Scolaire, based on the highest percentage of refugees as per the data available at the time of selection and the willingness of the principals and educators to participate in the project. The selected schools were located in five governorates (Mount Lebanon, North, Beirut, South and Bekaa) with a percentage of refugees ranging between 20% and 60% (with the exception of four schools in which the percentages ranged from 3-18%. These schools were chosen to increase the geographic diversity of the schools represented in the project).

The project description was shared with the schools and all participants were given detailed information along with the requirements for teachers' participation. After starting the program, seven schools were replaced for various reasons beyond control and hence there were two groups of teachers, one that started in February 2017 and one in December 2018; both groups followed exactly the same process.

Table 3.1 presents an overview of the 21 participating schools.

Location	Number	School Name	Percentage of Refugees	Number of Students	Number of Project Participants
Beqaa	1	Haouch Al Oumara Public High School	21%	217	5
	2	Public High School Bar Elias	42%	321	5
	3	Public High School Saadnayel	15%	655	5
	4	Arayish Public School Wadi Al	51%	149	5
	5	School Al Huda**	35%	697	5
Mount Lebanon	6	Kfarmatta Public School	61%	59	5
	7	Baakline Public School	66%	289	6
	8	Antelias Public School	29%	334	6
	9	Second Jbeil Public School	30%	275	7
	10	Yahshouh Public School	30%	147	18
	11	Farid Salami Public School - Kfarzebian	109%	343	5
	12	Haret Sakher Public School	18%	381	5
North	13	Saba Zreib Public High School for Boys	3%	179	6
Beirut	14	Rafic Hariri Public High School - Shoueifat	11%	742	6
	15	Beirut Al Alia Public School for Girls	28%	137	12
	16	Andrawos Tueini Public High Jubran School	10%	282	12
	17	Public High School First Basta	33%	214	5
	18	Zahia Kaddoura Public School	10%	227	6
South	19	Jahiliya Public School	40%	211	15

	20	High School Shheim Public	18%	280	5
	21	Public School Shheim	57%	381	5

Table 3.1: Participating Schools in the DLI Project

Table 3.2 presents an overview of the additional schools focusing on vulnerable and underserved Lebanese communities.

Location	School Number	School Name	% of Refugees	Number of Students	Number of Project Participants
Beqaa	1	Khorbit Kanafar Public Vocational School	7%	103	5
	2	Saint coeurs - Zahle	20%	304	5
Mount Lebanon	3	George Frem High School - Jounieh	0%	250*	7
	4	Hammana Public High School	0%	250*	7
	5	Technical Institute of Batroun	5%*	150*	5
	6	Father Andeweg Institute for the Deaf	23%	74	0
	7	Ihmij Public High School	5%*	75*	5
	8	Amshit Public High School	0%	150*	0
North	9	Rene Mouawad Technical School	0%	150*	0
Beirut	10	College Khadija El Kobra - Makassed	4%	292	5
	11	Makassed Ali Bin Abi Taleb School	10%*	250*	5
	12	Makassed Ali Bin Abi Taleb High School	5%*	250*	5
	13	Sophia Hagopian College - Bourdj Hammoud	10%	250*	5
	14	Aksor Kassarian School - Bourdj Hammoud	42%	292	5
South and Shouf	15	Al Wafaa Secondary School	2%	609	5
	16	Shouf High College	15%	175*	5
	17	Maghdousha Technical Public School	0%	165	5
	18	Deir Al Qamar Public technical school	10%	88	0

* approximate numbers

Table 3.2: Vulnerable and Underserved Schools Participating in the DLI Project

There were various reasons that schools provided for not completing a project with students and included the following:

- The teacher supporting them was unable to attend working sessions due to conflicting schedules with teacher professional development sessions, their own teaching schedule or additional work related to teach refugees;
- The school for the deaf and blind felt they needed more time to work on projects with students.

3.3.2. Project Intervention

The intervention was designed using IEA's Teacher Professional Development, Learn-As-You-Work² (LAYW) methodology which is process and outcome oriented and guides teachers step-by-step on how to apply the program in their own context. The process combines pedagogical and technological skills engaging teachers gradually from simple to more complex concepts and tasks that support and reinforce the learning goals set by the national curriculum. The outcomes are aligned with problem-solving skills and provide training in a blended manner with interpersonal workshops followed by continuous tracking and online support. The methodology enables teachers to slowly gain confidence as they work with their students and to track the progression of teams as they select a problem to address and develop relevant solutions.

Table 3.3 presents the projects developed and shared during students' exhibition at the Ministry of Education and Higher Education.

² <http://iea.org.lb/Sections.php?ID=3>

Project Name	Description	School	Team
Detector of Two Persons in a Toilet Cabin	A system that detects two persons in a toilet cabin and operates an alarm at the school's admin to protect children from sexual harassment.	Jbeil Second Public Middle School	4 Syrian males 0 Syrian female 1 Lebanese male 2 Lebanese females
Auto-bell	Automatic bell that operates according to the school's schedule and holidays, the school has three floors and one supervisor.	Baakline Intermediate Official School	1 Syrian male 0 Syrian female 3 Lebanese males 2 Lebanese females
Blind Aid Stick	A stick that warns the blind about the presence of hurdles in its way through sounds that it emits.	Institut Technique de Batroun	0 Syria male 0 Syrian female 3 Lebanese males 0 Lebanese females
Electro Power Station	A clean power station that uses the Raspberry Pi.	Jahlieh Public Middle School	2 Syria males 0 Syrian female 3 Lebanese males 0 Lebanese female
Septic Tank Alarm System	An alarm system that warns about the increase of water level in a septic tank.	Yahshoush Mixed Public Middle School	5 Syria males 0 Syrian female 13 Lebanese males 0 Lebanese females
Medical Room	A room that provides medical support at home.	Martyr Rafic Hariri Secondary School, Doha Choueifat	1 Syria male 1 Syrian female 2 Lebanese males 2 Lebanese females
Door Opening System	A system that opens doors automatically for handicapped in public spaces like supermarkets, hotels, and restaurants.	Hoch El Omara Secondary Public School, Bekaa	1 Syria male 0 Syrian female 3 Lebanese males 2 Lebanese females
Raising Awareness About Nature's Cleanliness	A digital story to raise awareness about the importance of keeping our environment clean.	Kfarmatta Public Middle School	0 Syria male 1 Syrian female 1 Lebanese male 0 Lebanese female
Animal Protection System from Cars	A system that protects animals and operates on the Raspberry Pi	Hammana Public School	0 Syria male 0 Syrian female 3 Lebanese males 4 Lebanese females
Robot vacuum cleaner	The Robot vacuum cleaner is a fully automated self-operated device for school yards that runs on the Raspberry Pi and programmed using Python	Antelias Public High School	0 Syria male 0 Syrian female 4 Lebanese males 0 Lebanese female
Protection of Children in Public Gardens	An alarm system that warns the operators of a public garden if children have approached the fence, it operates a light and an alarm.	Beirut Al Aliah Public Middle School for Girls	2 Syria males 2 Syrian females 2 Lebanese males 2 Lebanese females

Table 3.3: Student Projects Presented at MEHE's Student Exhibition

In summary, 72 students presented their projects at the Ministry of Education, 28% of them were Syrian students, with a majority of boys, 75% versus 25% girls.

The interpersonal teacher professional development workshops consisted of six days spanning over four months, to teach teachers how to use the CMDI Kit. At school, teachers dedicated an hour a week with

their students using the same process that they followed during the interpersonal workshops in addition to after school hours to support the final stages of development of students' projects. In addition, four working sessions were offered to teams of students when they were working on their projects

In addition to workshops and working sessions, 54% male and 46% females between the age of 14 and 18 participated in community events which spanned over the project duration including:

- A sharing day with twenty-three teams in June 2017
- Five hackathons with 92 students with 53% boys versus 47% girls
- A career guidance day with 18 students in August 2017
- A showcase of students' projects (12 projects and 72 students) at MEHE in January 2018
- Participation of 22 teams in the Second Lebanon Raspberry Pi competition in April 2018.

3.3.3. Career Guidance Activities

As part of the project implementation, a training program on career guidance was delivered to the most underserved students from the Bekaa: 18 Syrians and Lebanese between 14 and 18 years of age. The one day career guidance program was promoted via school teachers and out of the 25 students invited, 18 responded. Few girls registered in the program: 28%, compared to 72% boys. The intention of the career guidance program was to understand the students' perception of their career paths and consider how it may be integrated in the project intervention. The data collected from students through focus groups and questionnaires were analysed and used to inform the detailed design of the CMDI Kit. During the career guidance program, participating students showed a deep appetite to understand and know their career pathways, and a keen interest in exploring their potential options.

Table 3.4 presents the list of all projects developed by all students:

Number of schools	School Name	Project Title
1	Al Huda School - Saadnayel	School Exit Organizer
2	Antelias Public School	Robot vacuum cleaner
3	Baakline Public School	Auto Bell
4	Bar Elias Official Secondary School	Saving Elictricity
5	Beyrouth Al Aliah Public School	La serre framboise pi
6	Beyrouth Al Aliah Public School	Protection of Children in Public Gardens
7	Gebran Andrawos Tweini Public School	The Tunnel Trafficmeter
8	Jahlieh Public Middle School	Electro Power Station
9	Kfarmatta Public School	Raising Awarness about environment
10	Rafik Al Hariri Official Secondary School	Medical Room
11	Saadnayel Secondary Public School	Smart Glasses for Visually Impaired People
12	Second Public School of Jbeil	Sexual Harassment Prevention
13	Shehim Official High School	SD-Tr@p
14	Shehim Third Official school	Accident free
15	Yahshoush Public School	Septic Tank Alarm System
16	Zahia Kaddourah Public School For Girls	Smart Control
17	Hoch El Omara Secondary Public School	Door Opening System
18	Al Wafaa Secondary School	Smart Sorting Trash Bin
19	College Khadija El Kobra - Makassed	Drive me safe
20	George Frem High School - Jounieh	Smart Car
21	Hammana Public High School	Système de prévention des accidents pour les animaux
22	Khorbit Kanafar Public Vocational School	Smart irrigation
23	Makassed Ali Bin Abi Taleb School	Amazing Color Creator
24	Makassed Ali Bin Abi Taleb School	Auto-Fire Fight System – Woods Protection
25	Makassed Ali Bin Abi Taleb School	School Watering System
26	Makassed Ali Bin Abi Taleb School	Automatic Cure System
27	Makassed Ali Bin Abi Taleb School	Gas Leakage Security System
28	Makassed Ali Bin Abi Taleb School	Sea Cleaning System by Eco-Friendly Submarine
29	Saint coeurs - Zahle	School's Kiosk
30	Shouf High College	Smart watering and Fertigation System
31	Technical Institute of Batroun	Blind Aid Stick

Table 3.4: Student Projects

Details of these events were promoted in the community beyond the teams participating in the project. The events were informal and aimed to help strengthen sharing, connecting and learning from each other.

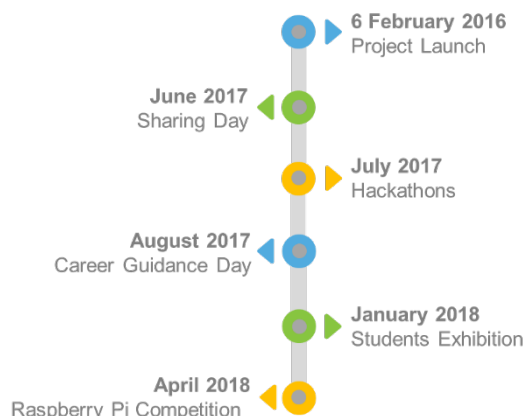


Figure 3.1: Project Implementation in Lebanon

The CMDI Kit developed by IEA consisted of the Coder-Maker program with tutorials, applications and open-ended pedagogical designs developed around challenging topics in the sciences curriculum, alongside technological equipment and open-source software.

The CMDI Kit also contains the following equipment:

- A Raspberry Pi (RPi) board
- Power supply unit (PSU)
- SD memory card
- HDMI to VGA adaptor
- Screen
- Mouse
- A variety of electronic tools selected by virtue of necessity to provide the most affordable, sturdy and reliable solution

It is worth noting that IEA's past experience of using the Raspberry Pi with refugees (2014-2015) has shown that the Raspberry Pi was reliable and did not require much maintenance.

The pedagogical application used Scratch and Python software packages which run on the RPi. Python is a simple yet robust and powerful object-oriented programming language which is well suited for beginners and provides a solid base for learning programming. It is a dynamic language which uses clear and logical language performed at run-time by an interpreter; it highlights the code in different colors and reinforces the importance of accuracy and correct syntax. On the other hand, Scratch (MIT) is a visual programming software with a wide range of literature about computational thinking and cognitive learning using Scratch in schools (Papert, 1980; Wilensky & Resnick, 1999). However, despite the excitement around Scratch and programming, there seems to be no significant evidence of enhanced learning or skills improvement with programming only (ibid), hence the importance of how it all fits in the overall pedagogy of the CMDI Kit.

Furthermore, the software packages Scratch and Python software are open-source, so schools don't have to incur additional licensing costs. Each package already has a thriving community to provide support and answer questions. To supplement the software taught as part of the CMDI Kit, teachers and students used the Internet, PowerPoint, YouTube, WhatsApp, mind mapping software, word processing, photo and video editing to communicate, research, design, take pictures, videos, present and share their projects.



Figure 3.2: Photos from the Sharing Day (June 2017)



Figure 3.3: Project Exhibition at MEHE with the Minister of Education HE. Marwan Hmadeh and HE Nicolas Sehnaoui, MP



Figure 3.4: Project Exhibition at MEHE

3.4. Findings and Analysis

3.4.1. Focus Groups

A total of five focus groups were held as follows:

	Stakeholders	Number of Participants
Pre-intervention	Principals	18
	Teachers group 1	24
	Teachers group 2	16
	Teachers group 3	14
Post-intervention	Teachers	18
	Trainers	5
	Volunteers	12

Table 3.5: Focus Group Statistics

Formal invitations to the focus groups were sent to all participants through official letters from MEHE and follow-up phone calls. All focus group lasted 4 hours, were held in Beirut and were conducted by the DLI research team. The conversations were recorded, transcribed and organised for coding.

Pre-intervention focus groups included an introduction to the project and an overview of what previous schools had completed. Principals were asked to discuss and share their perceptions about teaching and learning, technology and the impact of Syrian students in their school. Teachers were asked to describe the approaches that they use in the classrooms, their experience with classroom projects and technology and the impact of refugees in their classes.

Post-intervention focus group included a debrief session and participants were asked to share their perspectives on the experience, the challenges they faced and how they were able to mitigate them.

3.4.2. Interviews

IEA research team conducted 9 in-depth semi-structured interviews interim (during) and post the intervention with the same participating principals, teachers and students. The interviews were all conducted in schools starting with the principals' in their office and followed by teachers then students. Principal and teacher interviews lasted around 45 to 60 min each, while student interviews generally lasted 30 min. Student interviews were in all cases held in the presence of teachers with the exception of one group.

In the interim intervention interviews:

- **Principals** were asked mainly how things were going-on with the project, how participants were selected and the type of learning that was happening;
- **Teachers** were asked how things were going for them, how they had selected students, the challenges they were facing, and how they were addressing them;
- **Students** were asked about their experience, if they enjoyed it or not, what they were learning and what challenges they were facing.

During the interim interviews:

- **Principals** inquired about their teachers and students' progression, saying that they noticed a lot of motivation around school;
- **Teachers** showed the delegation the project wall with students' interest, community questions and where they worked with their students. They spoke with enthusiasm and motivation and discussed their projects' progression;
- **Students** shared their interest and projects and asked if there could be more working sessions. They explained how they created their bulletin board, the ideas they had around the community problem and showed how they were learning and applying the technology.

In the post intervention interviews:

- **Principals** were asked about the whole experience in their school and how they saw next steps;
- **Teachers** were asked about their experience and its impact on them;
- **Students** were asked about their experience and what they learned, if/what did they enjoy and what made it enjoyable.

The findings of these interviews can be summarized as follows:

1. **Principals** took time to describe in details the intervention in their schools. Most of them said that it had impacted their school deeply, well beyond teachers, and that it had transformed students and discussed next steps;
2. **Teachers** spoke with motivation about their experiences, the benefits for them and their students and how they tackled challenges;
3. **Students** spoke about their project, how they were going to continue and the impact of the project on them. Generally, they had a clear vision, were focused and articulate. Their body language was

attentive, they listened and wanted to know about the next steps. They spoke with determination and self-assurance about their projects.

Akram's Story

Akram is Syrian student learning in a school in the Bekaa. He was described by his principal as a thug who was severely ill-behaved beyond anyone's imagination. His parents were divorced, and his teachers had been desperately asking the principal to do something about the situation.

Akram had been consistently failing his subjects and doing everything to be expelled from school with the intention to help his father financially. Rather than expel him, the principal assigned him to the DLI Coder-Maker project and Akram became the driving force of the project.

Originally, the principal had not shown great enthusiasm to participate in the program due to negative past experiences with ICT-based initiatives. He followed carefully the progress of the team at school who worked on a smart glasses project created for Alia, a 12 years old girl who squints and has a severely impaired vision.

Today Alia plays at school without being ridiculed by her classmates and does not bump into things or people anymore because her Smart Glasses inform her how close she is getting to them; so she stops at the right distance and looks as normal as every child around her!

During the interview, Akram articulated a clear mission statement for the team's project saying with emotion in his voice, *"I will only stop when no one in the world is called blind."* He mentioned feeling *"happiness inside"* when he saw the impact on Alia and her joy to be able to move around independently.

Akram's vision is to continue working on the project to help the visually impaired lead as normal a life as possible and not be labelled as 'blind'. He knows he would like to focus on vision and technology in his future studies.

The Smart Glasses for the Visually Impaired have been designed and built by a team of two Lebanese girls, Mariam (Alia's sister) and Manal, and their Syrian refugee classmates, Akram, Mahmoud, and Kamal, who are students of Grades 10 and 11 in a public school in the Bekaa, Lebanon.

The team was concerned that the waves might have a negative impact on Alia's brain and conducted extensive research with support from their Technology teacher who sought support from the Science teacher. They discussed their plans and ambitions during working sessions and adjusted their goals to be realistic and achievable. They often stayed after school till 6 pm to design, code, and wire the glasses, and sometimes continued their research and tests at the home of the two Lebanese girls where they were received by Alia and Mariam's parents.

With the help of the team, Akram started studying and his grades improved, particularly in science (Akram's grade in physics increased from 20/60 to 56/60 - quite a remarkable change). Akram became more motivated to learn and his father visited the school to thank the principal and inquire about the radical transformation of Akram's behaviour and school achievements.

During this first stage, the glasses are equipped with a Raspberry Pi computer, an ultrasonic sensor, and a motor that vibrates at different intensities when an obstacle is in front of Alia at 3, 1.5 and 0.5m. In the second stage they will install a lighter sensor, a 3D camera to identify things around her, and electronic components to communicate better with the brain.

Today, each team member knows what they want to study: Akram wants to specialise in eye vision, Kamal wants to be an Engineer, Mahmoud wants to study Computer Science and Mariam wants to do Marketing.



Figure 3.5: Saadnayel DLI Team, Smart Glasses Demonstration

3.4.3. Observations

During the project implementation, the research team carefully observed the participants (teachers and students) and documented their observations. Key findings from these observations include the following:

- Students demonstrated a high level of collaboration and team work
- Teams worked resourcefully to bring together everything they needed to complete their project
- Teams showed significant perseverance and did not shy away from failure; they repeated the process, questioned, researched and learned from their mistakes
- Teams showed significant self-organisation, and were able to successfully split work and share responsibilities to get the job done
- Teams also showed a noticeable inclination towards sharing their work with the outside world. Many published their project videos on YouTube and WhatsApp

3.4.4. Questionnaires

Teachers and students were asked to fill a post-implementation questionnaire to provide feedback on the overall experience; 20 teachers and 81 students filled the post implementation questionnaire at the completion of the project. The questionnaire included a rating scale from 1 to 5 as follows

- 1 = Not at all
- 2 = Somehow
- 3 = Generally
- 4 = Mostly
- 5 = Extremely

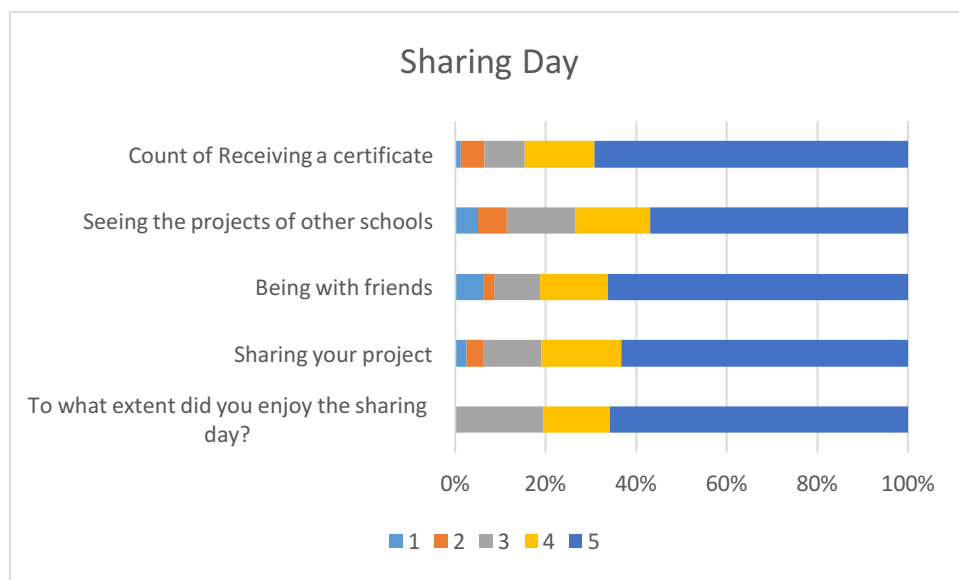


Figure 3.6: Rating of the Sharing Day

The figures show that all participants appreciated the experience with more than 60% extremely appreciating sharing their projects and being recognised publically by receiving a certificate of completion. In addition, learning with peers was also rated by 60% of participants as significantly contributing to making the experience enjoyable, while seeing the projects of others seemed important to a slightly lesser degree (45%) since they had already seen each other’s projects during working sessions.

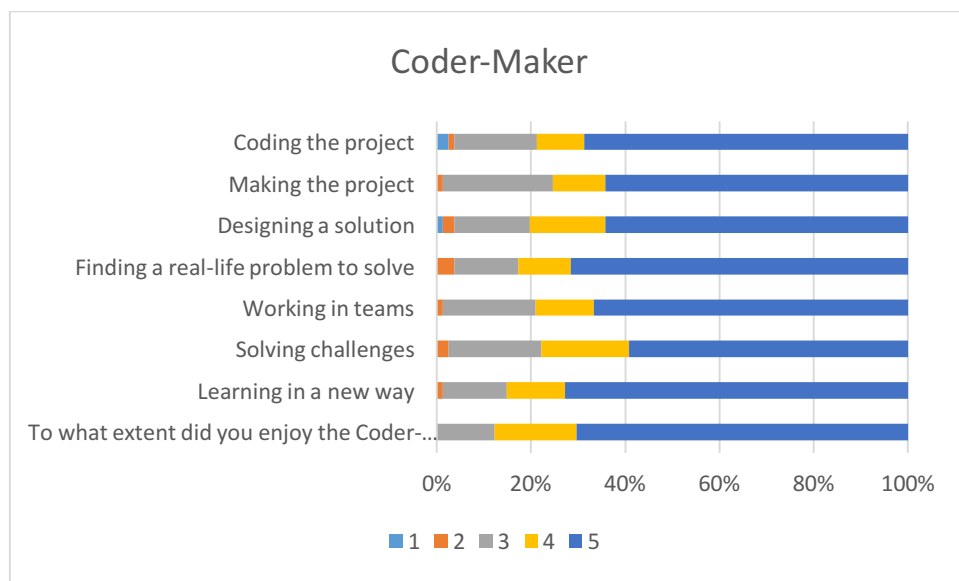


Figure 3.7: Rating of the Coder-Maker Approach

In their answers to the overall DLI Coder-Maker experience, students found the experience enjoyable to different extents, with more than 60% of participants reporting it being “Extremely enjoyable”, around 30% reporting “Very enjoyable” and 10% as “Enjoyable”.

When answering to what extent each of the elements made it enjoyable, *learning in new ways* was reported as extremely enjoyable by more than 67% of participants, very enjoyable by 12% and enjoyable by 20%. What participants seemed to enjoy most was “*finding a real-life problem*” (with 73% extremely enjoyable, 12% very enjoyable and 14% enjoyable) and *Coding their project* with 72% rating it as extremely enjoyable, 11% very enjoyable and 14% enjoyable.

What seemed more challenging for participants was “*designing a solution*” and “*solving challenges*” which appeared with 64% and 59% respectively as extremely enjoyable versus 16% and 19% as very enjoyable and 16% and 20% as enjoyable. This indicates that despite the challenges that they faced, they thoroughly enjoyed the learning experience. Furthermore, they thoroughly enjoyed coding and making the project which appears in the respective rating of 72% and 69% as extremely enjoyable, 11% and 10% as very enjoyable and 14% and 18% as enjoyable. It is worth noting that working in teams was also rated extremely enjoyable (64%), very enjoyable (11%) and enjoyable (23%) which is in-line with what participants mentioned earlier about learning with peers.

3.4.5. Assessment of Students’ Projects

In order to assess the students’ problem-solving skills and overall performance in the project, a rubric was developed and given to teachers at the end of the intervention. Teachers were able to add comments to explain their ratings. The rating range was as follows: Exemplary (5-4), Good (3-2), and Needs Improvement (1). A total of eighteen educators filled the rubric: 10 during the last face to face meeting and 8 returned by email. Key findings of the analysis are as follows:

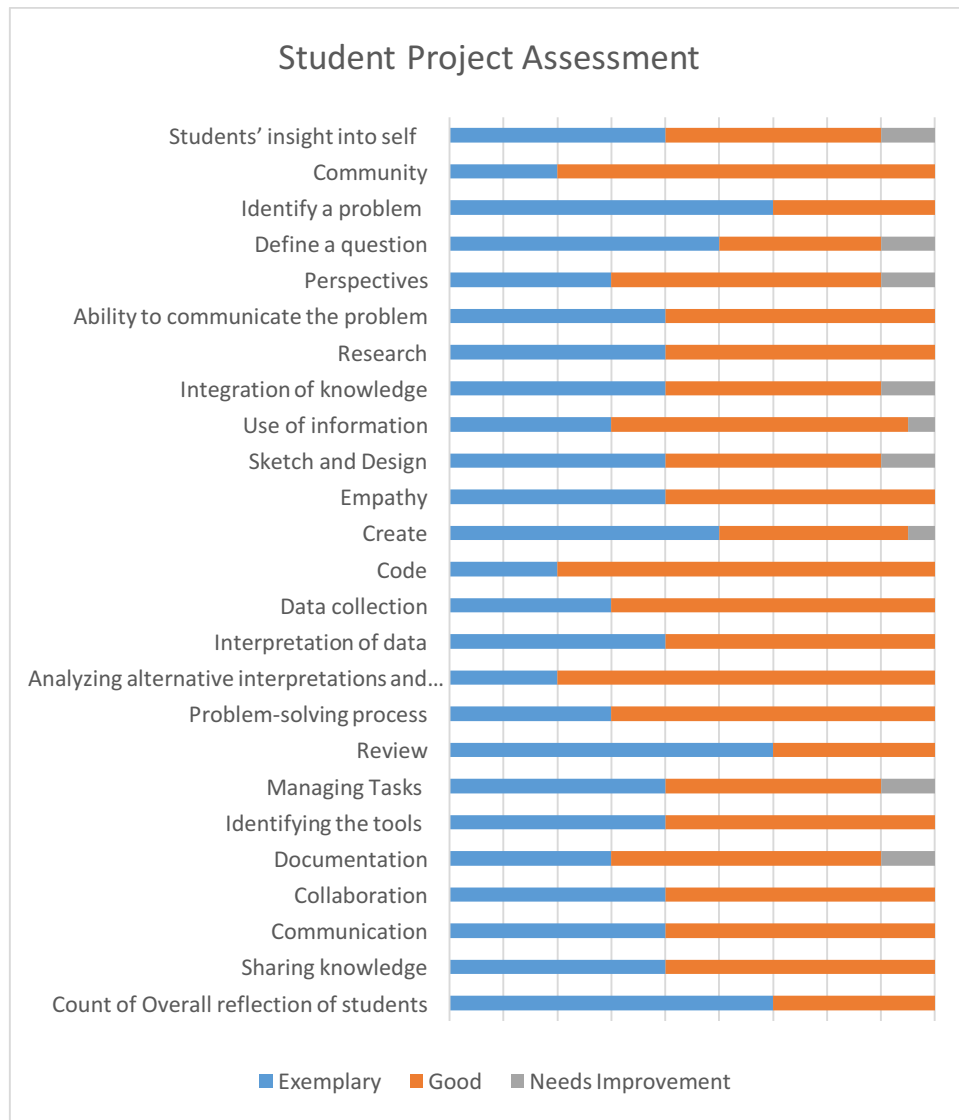


Figure 3.8: Results of the Project Assessment Rubric

The assessment clearly shows students' significant achievements in:

- Analytical skills, computational thinking (coding) and insight into the community** with 78% of teachers rating students as good and 22% as exemplary: This reinforces what most teachers reiterated in the interviews with “thinking and problem solving” as the most important skills demonstrated by students. Computational thinking skills were further validated in the interviews with students, who said that what they gained most was not only learning to code but understanding the code and using logic. In addition, insights into community were mentioned by teachers as significant and visible in the social improvement of students and how they socialised their ideas.
- Problem identification, reflective thinking and reviewing their work** was rated by 67% of teachers as exemplary and 33% of them as good. All teachers thought that their students had gone through great lengths to identify a problem and did very well because the problems they identified were all sensed in the community. They mentioned that they started exploring a wide

variety of problems and they needed a lot of assistance in order to focus on one problem in detail rather than surface many. As for reflective thinking, teachers mentioned that students demonstrated metacognitive awareness and ability to reflect on self-knowledge, use productive habits of mind, and reflect on the meaning of the learning and experience. As for the reviewing of their work, teachers found that students had strived to review their work and learn from their errors, and in the process explored new ways to approach and solve problems.

- **Defining a question, creating their prototypes and sharing knowledge** was rated by 56% of teachers as exemplary. On the other hand, creating a prototype was rated as good by 39% of teacher and sharing knowledge was rated good by 44% of teachers which tallies with the overall joy of students to create and share their project. In addition, a small percentage of teachers (11%) explained that further improvement needed to be made to better define research questions.
- **Problem solving, data collection and use of information** were rated by 67% of teachers as good and 33% as exemplary which is in-line with teachers' explanations of how students posed a question, hypothesised, collected data and questioned the information.
- **Researching, collaboration, ability to communicate the problem, communication,** were rated by 56% of teachers as good and 54% as exemplary.
- **Empathy, interpretation of data and identifying tools** were rated by 44% of teachers as exemplary and 56% as good.
- **Recognising perspectives, documenting project** were rated by 56% of teachers as good and 33% as exemplary, while 11% of teachers mentioned that further improvement can be made in these areas.
- **Integrating knowledge, managing tasks, sketching and insights into self** were rated by 44% of teachers as exemplary and 44% as good, while 11% of teachers saying further work needed to be done in some areas. Several teachers added notes explaining how new concepts were used into their project and in the problem-solving process; yet this also means that work remains to be done in some areas to fully integrate information in the process, particularly while sketching. For task management, teachers who reported it as exemplary explained that the team took the initiative to define tasks, set timelines, match assignments to expertise, share responsibilities, maintain open communication, and develop strategies to enhance group success; while those that rated task management as good mentioned that students had a challenge to complete the tasks within the assigned time. As for gaining insights into self, teachers mentioned that it had been hard for a few students at the start because they were unable to disclose their feelings and were not inclined to talk about themselves. Yet, this changed gradually as they started working in teams, which is significant knowing the psycho-social impact of violence on this young population.

3.5. Synthesis of Findings

The project implementation unveiled an extensive set of findings across multiple aspects of the educational experience. The following sections outline the key project findings.

3.5.1. Challenges in Providing Effective, Accessible Education for Refugees

The first research question in the project focuses on identifying the challenges that face the provision of effective, accessible education for refugee children in host communities. The following challenges were identified as having significant and detrimental impact on the provision of education in host communities:

1. **School violence** was reported by principals and educators as a serious problem among Syrian students, with negative consequences on the Lebanese population and a high drop-out rate of Lebanese students. Situations that start around small disputes quickly escalate to violent encounters with intensity not usually in proportion with the issues that gets children upset in the first place. Even the games they play are violent. A boy, for example, beat his sister really hard

just because she had a better grade than him in Math. Evidence of violence was also seen in the vast number of harmful objects confiscated on the school premises.

2. **Preparedness to cope:** the crisis drained schools and increased the administrative overhead in an extremely top-down bureaucratic system.
3. **Adapting to a different learning environment** was most challenging for Syrian students who had suffered war, had no home and had to adapt to a different culture including learning core subjects in a foreign language.
4. **Working students:** Syrian students work at a young age after school to contribute to the family income. They work in the fields, stores, restaurants etc. and although children often come to class tired, teachers found that this makes them also responsible at a younger age compared to their peers.
5. **Fear and respect:** teachers mentioned students' "deep respect for" but also "fear" of teachers and the overall system with a strong sentiment of fear of physical punishment. Teachers reported that at the beginning of the school year, when they walk around in class, children bend to hide their heads with their arm as if they were going to be slapped.
6. **Teachers' skills:** with the exception of a few teachers who apply active teaching and learning, teachers have a tendency to deliver content rather than skills and all fingers were pointed at the old curriculum (dating back to 1998) that encourages teachers to perpetuate rote learning and focus on preparing students to pass exams.
7. **Lack of motivation:** Educators repeatedly suggested that they are unable to motivate and interest learners.
8. **Disempowerment:** There was a general feeling of disempowerment, a feeling that "I can't do it or I can't do anything" at the start of the project and that issues were impossible for them to address.
9. **Ambivalence of technology(ies):** Although technology was perceived by educators as a motivating tool they found it challenging because of the lack of capacities. They considered the younger generation of contractual teachers more attracted to use technology while the lower number of cadre teachers, usually close to the retirement age, being less inclined to adopting and using new technologies.
10. **School drop-out** remains an unresolved challenge in public schools. For example, there are no afternoon shifts for high schoolers, despite the enormous efforts to retain students since the start of the crisis.

The DLI project aims to develop tools and approaches to help address these challenges based on its central thesis that digitally-assisted learning can improve the quality and accessibility of learning for refugees and host communities inside and outside the classroom. The intervention kit developed during the project is the central element of the Ecology of Digital Educational Tools and Resources proposed by the first project goal.

3.5.2. The Impact of Digital Learning Innovations in Post-Emergency Situations

The second research question focuses on the impact of digital learning innovations on improving the educational process in post-emergency situations. The implementation of the CM DLI Kit revealed key insights into the relevance and effectiveness of digital learning innovations, particularly in post-emergency situations. An important observation was that the holistic approach embedded within the CMDI Kit was instrumental to stimulate the interest of both teachers and students beyond the initial attractiveness of technology gadgets, and well into learning and scientific curiosity. It is very important to note that the tools and resources alone would have had a very limited effect without the innovations in the process of teaching and learning. This highlights the importance of the integrated pedagogical and technological process to address the challenges that resulted from the crisis and proper to the local context of the host communities.

Case in Point: Detector of Two Persons in School Toilets

Amira teaches Math and Sciences in Middle School and Randa teaches Social Sciences and Math in elementary school in a public school in Mount Lebanon. They are both cadre teachers and joined the DLI project in the first round of workshops and developed a project with their students to prevent sexual harassment in school toilets.

The second year, they each integrated the project in their classes and Amira taught an additional hour of technology to grade 7. Their principal was very supportive and followed the project closely. Their students, four Syrian and three Lebanese students came up with the idea of preventing sexual harassment in school toilets. Their aim was to find ways to prevent things like that from happening rather than lament when it is too late.

The idea appeared to be extremely challenging, but the encouragement of their peers, teachers and principals during the workshops and working sessions stimulated them. The question they asked themselves was: How might technology be used to detect two persons in the toilet?

The seven students met with their teachers every day at the break but also on Saturdays, learnt Python programming and worked on design challenges with their teachers despite the fact that two of the Syrian students were working during the weekends and some evenings.

The challenge was to design a solution. They explored all sorts of sensors, thinking that although a camera might detect people in the bathroom, it is not possible to use one out of privacy concerns. So what type of sensor might detect two persons in a toilet? Everyone told them it was too difficult a problem for them to address, including a professor of robotics engineering in Sweden whom they contacted for help. They kept working, visited several electronic stores in Lebanon and explored the Toolkit.

The support they got through visits, discussions and working sessions helped them in many ways, particularly when they felt discouraged after researching and testing all types of sensors. They realized that they had to think differently and that the project was not all about sensors.

They sketched their prototype and discussed their drawing and hypothesis during working sessions with trainers and volunteers. Ideas bounced back and forth, the problem seemed very complicated and they started to feel desperate again. It is through investigating different hypotheses which they analysed and evaluated with their sketches that the scenarios started to make sense and they found a solution.

They built a mock-up of the toilets and coded their solutions, got two figurines and tested all sorts of scenarios, where to put them, what and how they might detect someone coming in or the movement of the person(s). The solution proved to be much simpler than anticipated, and they were able to solve the problem with only two ultrasonic sensors.

As the project came to completion, grade 9 students presented and passed the Brevet National exams and went to a different Secondary school where one of their teachers wanted to do a project around racing cars. Mahmoud, said, "What purpose is there to invest my time on such a project, how is it helping others? I prefer to come here and continue working on the project and build a real prototype". All students still come to their school to work on the project in order to develop a full prototype.



Figure 3.9: Jbeil DLI team, Sexual Harassment Prevention, explaining the project to IDRC Program Director



Figure 3.10: Jbeil DLI Students and Teachers with IDRC Program Director

By embracing a holistic, pedagogically sound approach to designing and developing the CMDI Kit, the project was able to create transformative learning experiences that stimulated motivation to teach and learn, strengthened teachers' capacities and resulted in more social cohesion, commitment of students to learning, more autonomy and self-organization, grit and self-confidence.

- **Motivation to teach and learn:** From a lack of motivation and interest, there was a spike in motivation to teach and learn. Observations and questionnaire data showed very high levels of motivation and commitment among students to their projects.

Case in Point: Akram's story

- Akram was committed to the project but also to the team. When he felt like quitting, he said, he stayed because of them and because he felt committed to the cause of all the blind
- He drove the project and became responsible
- The team of students self-regulated and organised themselves
- They worked together and there was more social cohesion between the Syrians and Lebanese students as they worked on the project

- **Teachers' capacity:** Teachers who participated in the project witnessed significant and rapid professional growth, including the development of critical, creative, reflective thinking and the capacity for solving real life problems. All teachers reported that they got to know their students better, and understood how they think and learn. As a result of the intervention, teachers were able in a relatively short period of time (only six days of training with ongoing support and working sessions) to adopt an open-ended, problem-oriented, technology-assisted approach and succeeded to guide their students to create innovative projects tackling significant challenges in a highly rigid and bureaucratic school system.

"I feel that I am born again, the experience was really unique" Debrief Session, DLI Teacher

...I feel I was renewed, all of it. It has impacted me deeply. I am still processing this experience. It is a shift in thinking, before I needed to control and tell students what to do in projects. Here, I have seen aspects of my students I did not know. I have followed their thinking progression. It has given space for conversation, for listening for hearing for communication. The conversation has changed; their behaviour has changed. There is so much more I can and will do as a teacher. Working session Beirut, DLI Teacher

- **Culture:** An important observation of the project impact lies in the dramatic changes witnessed within the school culture: Students became more collaborative and cooperative, and bridges were built between students and their teachers, strengthening communication and the sense of common purpose.
- **Social cohesion:** The dominance of violence and disruptive behaviour waned in favour of more harmony and social cohesion at school. During the whole project, no dispute between Syrian and Lebanese students was observed. Instead, constructive collaboration and social learning seemed to have become the norm.
- **Commitment to learning:** In an environment where high dropout rates prevail, students' commitment increased substantially throughout the project. Students showed a deep commitment to one another and towards a mission of taking action for social good. In a culture where the norm is for children to work, it is significant to see parents who rely on the income generated by their children's work encouraging them to spend time on their project rather than work to earn money.
- **Self-regulation:** Students developed a high sense of responsibility, demonstrating the ability to self-regulate, organise themselves and be responsible for completing their project on time.

- **Self-confidence:** This is probably one of the most remarkable observations in the project. Participating students seemed to have transformed from a fragile and weak self-perception that was severely damaged by what they witnessed in the war to see themselves as resourceful problem-solvers with the ability to face problems of the future.
- **Perseverance and Grit:** Students showed significant improvement in perseverance and grit in the face of the challenges they faced designing and developing their projects. The exploration-based process necessary to solve the interdisciplinary, often novel problems presented by the CMDI Kit nurtures perseverance and reinforces grit. Evidence of these improvements were reported by both students and teachers.

“What have you done to my son, he is transformed, calm and passing. Thank you” Parent of a Syrian boy

“We don’t want the program to stop, the children benefit so much” Parent of a Syrian boy

3.5.3. Transitioning to Higher Education and Career

Key findings of the career guidance camp indicate that 50% of male students considered higher education inaccessible and financially unreachable and were considering vocational or technical fields. None of them knew they could get a scholarship or ever considered learning online as a possibility. Out of the 50% who considered higher education accessible wanted to pursue careers in journalism, engineering, teaching, civil aviation and medicine. The career guidance intervention revealed that most of the students lacked knowledge of self and were not able to articulate their interests. This was a key consideration for informing the design of the CMDI Kit.

Based on these findings, and in order to remedy the low turnout of girls, the DLI team strengthened the component of exploring the students’ own interest in the second iteration of DLI. Teachers were instructed to discuss with the students the possible career paths and achievements that can be attained by knowing and pursuing these interests.

In this manner, career guidance was blended as an integral part of the DLI intervention and impacted a much larger proportion of students, ultimately leading to higher influence on girls. Across the intervention, students who engaged in the DLI had a very clear view of what they want to become and what they should study to achieve it. The project data indicates that the career choices popular among girls include marketing, graphic design, photography but also engineering, computers studies and teaching. The majority of boys chose STEAM-related career paths, including computer science, biomedical engineering, engineering, agri-tech etc.

Comparing the outcomes of the first 18 students who participated in the project with those that joined later demonstrate the benefits of team engagement and responsibility in project work. Students who participated earlier developed deeper interest and knowledge in the fields that align with their interests and passions. To further improve the transition to higher education and career, it is recommended that future project iterations include an additional module targeting high school students to help them with university admission and orientation towards scholarship options. Another module can be added to assist students who want to continue developing their projects into viable products.

3.5.4. Cost-effective, Quality Education at Scale

The use of technology to support the educational process is not new. Numerous projects attempted to leverage the potential afforded by technology to improve and transform the learning experience, with varying degrees of success. Key to the ability to unleash the potential of technology to address the substantial challenge of ensuring access to education to the millions of refugees who fled their homes into host countries is to design an efficient and cost effective solution that can be easily scaled and replicated.

The consideration of cost and scalability was central to the design process of CMDI's Kit. The project team strived to find the most effective approaches for the least possible cost and the highest potential for scalability. For example, the CMDI Kit uses the low-cost, powered by the open source Raspberry Pi computer instead of more expensive hardware solutions. The Kit's pedagogical design also promotes the development of solutions to real world problems, which usually require interfacing with physical objects, sensors and actuators. The open ecosystem of the Raspberry Pi offers many reusable low cost (or totally free) components that can be used to achieve this goal.

On the software side, the CMDI Kit leverages several open source tools and packages, including Scratch and Python. By using personal SD memory cards, students can easily store and transport their work from one place to another, and can simply plug the card into any Raspberry Pi device to get to their own work and development environment.

The consideration for cost and scalability was also a fundamental guiding principle for the capacity building component of the CMDI Kit. The capacity building component consists of only 6 training days which span over the academic year, minimizing the burden on participating teachers. The delivery model is based on pedagogical training by qualified educators and technical support and skill development provided by volunteers. This hybrid model reduces costs without compromising the quality of training or continuity of support. CMDI Kit's "Learn-As-You-Work" model spreads learning over time to give space for teams to digest and apply their learning before they progress to learn more complex concepts.

The combination of low cost hardware components, open source software, online and in-person training and support offers an affordable solution that can be easily scaled to contribute to the massive undertaking to educate millions of refugee children. While concrete figures for scaling DLI nationally need to be researched with financial experts, current IEA estimates suggest the possibility for national scaling at \$2 per student per month over 3 years.

3.5.5. Gender Equality

To mitigate against possible gender balance, the project team took the following actions:

- At the onset of the project, school teachers were told to enrol an equal distribution of boys and girls and to propose the project to interested students.
- However, a disadvantage for girls was noticed, as teachers invited the students that they thought might be interested. Early enrolment had a significant gender bias with 75 % boys enrolled versus 25 % girls.
- To validate the lower interest in the project among girls, hackathons and community events were promoted directly to the community. We observed higher levels of interest among girls. Out of the 92 participants who enrolled, there were 53% boys versus 47% girls, a clear increase in the participation of girls. Through discussions with girls, additional ideas were captured to give wider access to girls, such as organizing a girls only hackathon.

- In addition, this prompted the IEA to develop prototypes and applications that are less mechanically focused to attract a wider range of interest.

3.6. Project Sustainability

The Syrian refugee crisis is enormous, with millions of displaced children that require education in host communities that are already strapped for resources and have struggles with educating their own students. This project demonstrates an approach that can leverage technology-enhanced learning, attract children to education, increase their motivation and help schools and teachers provide effective and efficient education. However, for this approach to meaningfully contribute to solving the challenges of education of refugees and host communities, sustainability and scalability are critical considerations.

In order to scale the project efficiently, IEA is planning a blended online learning professional development program for teachers of primary, intermediary and secondary schools. In addition, all tutorials, applications and design challenges created for the DLI will be published on the Coder-Maker site under a Creative Commons license. This is coupled with IEA's efforts to develop a set of printable Coder-Maker courses and teacher guides for wide dissemination.

While early signs of interest and commitment from some teachers and principals can be observed, ensuring that the changes are sustained required focused effort into obtaining buy-in from key stakeholders, enacting relevant policy changes, build the necessary partnerships, and find resources to support scaling.

The project was able to secure stakeholder buy-in at the highest levels, and obtained endorsement from the Lebanese Minister of Education. Support and buy-in was also obtained from other key stakeholders, including school principals and the parents' community.

On the policy front the project formulated a set of concrete policy recommendations and is actively promoting these changes at all levels within the Ministry of Education and the Lebanese government. The project also enlisted support from several partners, including Fondation Mouna Bustros (FMB), Beirut Digital District and IEEE Lebanon Chapter. This partner network must be sustained and strengthened to support fund raising and allocation of resources needed to scale the project.

The sustainability and scaling efforts may also be able to leverage the skills and capacities built during the project for 61 teachers and 18 volunteers as catalysts for recruiting, training and supporting new beneficiaries.

3.7. Implications for Policy and Regulation

For DLI's impact to be achieved at scale, several existing policies and regulations need to be adapted, and new ones to be enacted. Following are the most important policy recommendations that came out of the DLI project implementation:

Policy recommendation 1: Integrate computational thinking in the curriculum

"Integrate computational thinking in the curriculum beyond the computer hour to leverage interdisciplinary synergies between teachers of different subjects"

Issue: Currently, computational thinking is not taught in the computer hour in intermediary and secondary schools and there is no computing at all in elementary schools.

Rationale: The existing computer hour in school still relies on an outdated curriculum taught by computer teachers stemming from a purely instructional and technical background that generally is more focused on technical learning than on pedagogy. However, by enforcing a computing hour in schools, computer teachers will be able to teach computation as well as support subject matter teachers in projects that integrate computational thinking. Hence, STEAM (Science, Technology, Engineering, Arts and Math) teachers will be able to integrate computational thinking in educational projects that reinforce the concepts taught in the classroom. The effectiveness of the synergy between computer science and subject matter teaching was clearly shown in the DLI intervention. While educators at the start feared their lack of capacity and knowledge, all teachers, computer and subject matter alike, have demonstrated in a relatively short period of time their ability to teach coding and infuse computational thinking in projects which enhanced learning outcomes. Moreover, elementary school teachers have also shown that they were capable of integrating computational thinking in their teaching, which was met by students' significant appetite to learn.

It is worth noting that, when university professors of computer, robotics, and engineering observed students' outcomes they stated that this would definitely lift the level of their own courses at university as those students would have already acquired the basics they are teaching to their first-year students.

Policy recommendation 2: • Adopt innovative digitally-assisted projects as an integral component within the school environment

Issue: Today, the choice of innovative digitally-assisted projects run in parallel to learning in an occasional manner, and the two are disconnected and not properly aligned.

Rationale: The DLI project was endorsed by the Ministry of Education and the school principals. This endorsement proved to be an important factor in motivating and enabling teachers to walk the extra mile and make innovation a reality within the classroom. If a palette of pedagogically sound projects designed to support and enhance classroom learning, such as the DLI, were proposed to teachers with the adequate official backing all learning outcomes of students would be enhanced.

Policy Recommendation 3: Leverage DLI's approach to increase student interest in learning and reduce dropout rates

Issue: with the still staggering student drop-out rate use DLI's approach to increase students' retention

Rationale: The DLI project relies on an innovative pedagogical process which has shown an increase in students' interest and motivation to learn. All students who engaged in the DLI projects perceived value in learning and pursuing their education rather than just working. This approach to learning in the present context can reduce dropout rate and increase motivation to learn.

Policy Recommendation 4 Use DLI's approach in using technology to address the capacity challenge resulting from the refugee crisis

Issue: DLI has shown to develop teachers' capacity as they learnt new ways of teaching and using technology

Rationale: DLI's approach is holistic and designed to enhance teachers' capacity depending on what they teach and where they are in the professional development ladder. All teachers without exception benefited from the approach and said that they had grown professionally. DLI can be used to increase teachers' capacity and grow their skills.

Policy Recommendation 5: Reduce the bureaucratic burden to empower principals to make decisions

Issue: Although approved by MEHE, the implementation of projects faced inevitable minor changes which require lengthy time from principals for approval.

Rationale: The DLI project was endorsed by the Ministry of Education, however, scheduling and additional events such as a sharing day, students' exhibition, or participating in educational conferences or free additional workshops and working sessions were made available and teams were invited to participate and exhibit their project. Every event required a formal lengthy bureaucratic process from principals to get formal approval to participate. If those minor decisions around an approved project were in the hand of principals with a systematic way of reporting activities, principals' positions and time would be maximized and enhanced.

Policy Recommendation 6: Develop innovative digitally assisted projects addressed to girls

Issue: Participation in STEAM programs is usually gender-biased towards boys, with smaller proportions of female participants

Rationale: The DLI has shown that girls have an appetite to STEAM activities despite the general societal association of STEAM fields with boys. With the increasing importance of STEAM in the jobs of the future and knowing that there will be a 38% worldwide shortage of STEAM skills in the future job market (Source: Manpower - <https://go.manpowergroup.com/talent-shortage-2018>), it is crucial to develop a STEAM program dedicated for girls in order to ensure that they can contribute equally to society. In the case of the Syrian crisis, this is even more important to have Syrian girls in leading STEAM careers to help rebuild their country.

Policy Recommendation 7: Leverage DLI's approach to help students make better informed career choices

Issue: Although there is a general feeling of disempowerment, with proper guidance and activities that link them to real-life situations, students can be empowered to make informed career choices

Rationale: Making career choices and deciding on one's future when higher education seems out of reach or not knowing how to make one's idea a reality is difficult for all students, but even more so when one's livelihood is at stake. Learning is a journey where students: "Learn to know, learn to do, learn to live together and learn to be", and therefore infusing it in the way DLI has approached it in its intervention in a holistic CMDI Kit makes it accessible and possible for all students to become and make informed choices that they will carry on for all their future.

4. Jordan Project Component

4.1. Project Impact

The project was implemented in 11 Makani centre spread across Jordan. In total, the project impacted 46 educators. Beneficiaries include facilitators of science, math and career guidance at these centres. In total, 95 xLOBs were developed during the project: 65 in science and math and 30 in career guidance.

4.2. Methodology

To assess the achievement of the project's objective and goals, and to extract findings and lessons learned to support further research and scaling of the project, the following research methods were planned:

- Focus groups with principals and teachers and post-intervention focus groups with teachers and trainers
 - One focus group with 10-12 math and science facilitators who attended the training program and implemented xLOBs with students
 - One focus group with 10- 12 life skills facilitators who attended the training program and implemented xLOBs with students
 - Two focus group sessions with the students. One session with students who learned by science and math xLOBs, and one for those who learned by career guidance xLOBs
- Questionnaires to facilitators

4.3. Project Implementation

In Jordan, the implementation of the project consisted of the following activities:

1. Needs assessment workshop
2. xLOBs and Career Guidance framework development
3. xLOBs design and development
4. Career Guidance xLOBs design and development
5. Design of the laboratory and required equipment
6. xLOBs capacity building program
7. Career Guidance capacity development program
8. Orientation session
9. Pedagogical support

The following sections describe each of these implementation activities.

4.3.1. Needs Assessment Workshop

The Birzeit University Center for Continuing Education (CCE), The International Education Association (IEA), Ford Foundation, IDRC and UNICEF jointly organized a needs assessment workshop in Jordan for 3 days from October 30th to November 1st, 2017 targeting the science, math and life skills teachers and facilitators at Makani Centers.

The workshop aimed to familiarize participants and partners with the project and to study the conditions on the ground in a participatory manner to inform the design and development process for the project. The design team was able to identify specific needs and main topics and sub topics to be covered in the experiential learning objects (xLOBs) to be developed as well as identify challenges facing teachers,

facilitators, and students at Makani Centers. The workshop created the baseline upon which the first draft of the xLOBs framework and the Career Guidance framework were developed.

The findings from the needs assessment workshop can be summarized as follows:

- Dropping out of schools is a significant challenge among refugee students
- Combining several grades in one classroom makes the learning process very difficult, and makes it difficult for the teacher to provide sufficient support to all students
- Technology is usually used in the classroom in ineffective or disruptive ways
- The current curriculum lacks focus and integration of life and interpersonal skills
- Existing pedagogical approaches and teaching methods are ineffective and unsuitable for modern learning
- Violence is prevalent among students, causing difficulties and disruption to the learning process
- There are no sufficient qualification and capacity building opportunities for teachers and facilitators
- Most refugee children seek work, which leads to irregular attendance and withdrawal in some cases
- Many refugee students have been outside school for several years, creating a gap between their age and level of education

4.3.2. LOBs and Career Guidance Framework Development

Two teams of subject matter experts, instructional designers and IT specialists were formed; one for the science and math xLOBs, and the other for the career guidance. The teams reviewed and analyzed the findings from the needs assessment workshops and the training materials and manuals currently in use at Makani centers.

The teams conducted several face-to-face meetings and several meetings on-line and carried out consultation meetings and brainstorming sessions with the partners, and developed the two frameworks: xLOBs framework for science and math and xLOBs framework for the Career Guidance. The frameworks were shared with the partners for feedback before they were finalized. These frameworks formed the basis for the design and development of the xLOBs.

4.3.3. xLOBs Design and Development

Multiple teams were formed for the xLOBs development. The teams consisted of subject matter experts (in science and math and in career education), instructional designers, experienced teachers/facilitators and IT specialists (whose role is to integrate technology into the xLOBs being developed).

The design and development process was very extensive: The various teams began by developing several design ideas. Those ideas entered the first round of reviews. Only some of the ideas were chosen for further development. Those ideas were then developed into the first draft of xLOBs. Each team then pitched the xLOBs to a jury. Once again, only a selected few were chosen for further development. Those xLOBs underwent further revisions, piloting and rewriting (and some were rejected along the way) – until final xLOBs were released.

This process required on-going work from the teams: individual work, weekly meetings, on-going feedback, training and coaching.

Each team worked in parallel with IT specialists to test and review the technology that was used in each xLOB. The specialists worked on developing the prototypes, and suggested different technological tools to the development teams and ways to apply them effectively.

Sixty-five xLOBs in Science and Math were finally released out of several hundred initial designs the project teams worked on. Those xLOBs were based on the framework developed form Makani and with Makani according to specific learning needs.



Figure 4.1: An Aspect of the xLOBs Design and Development Process

4.3.4. Career Guidance xLOBs Design and Development

The Career Guidance development process was similar to the xLOBs development process for science and math. The teams reviewed existing resources, conducted several meetings, brainstorming sessions, developed preliminary ideas, pitched them, developed several rounds of design and development, pitching them at every round, until the final xLOBs were developed and released. Stakeholders including the partners, facilitators and teachers, were consulted regularly throughout.

The guide consists of 30 xLOBs that each was developed to help the target group manage their career, learn new things, and take new steps, to improve on the personal and the professional level.

4.3.5. Design of the Laboratory and Required Equipment

The integration of the technological components into the xLOBs required the establishment of the laboratory for testing and experimenting with different tools and equipment that may be used for the integration of technology into the xLOBs. The laboratory was based on lab designs and tutorials shared by the IEA at the start of the project, and consisted of different technological tools ranging from Arduinos, Raspberry Pis, sensors, motors, 3D printers and tablets to soldering irons and glue guns.

As xLOBs were being developed, the tools and equipment required to implement the relevant xLOBs were specified. The list of required tools and equipment were annexed to the relevant xLOBs. The list was provided to the partners to be procured and made available to the Makani Centers.

4.3.6. xLOBs Capacity Development Program

The capacity-building program was designed for teachers on how to implement the xLOBs, it was built as a "learning journey" for participants focusing on the design and the development of learning goals and the process before they implement it in the classroom.

The Center for Continuing Education team implemented a 4-day training workshop for the teachers on how to use and implement the xLOBs in the classrooms between the 3rd and the 5th of June 2018. Sixteen (16) science and math teacher and supervisors from 11 Makani Centers participated in the training. Another follow up training workshop was conducted on the 17th of June 2018. Twenty-eight (28) science, math teacher and supervisors participated in the training.

At the end of the training the team carried out an evaluation and a reflection session to assess effectiveness and outcomes of the training workshop. The participants' impressions were very positive, they found the training well managed, insightful and provided excellent and new information. They stated that the training helped them in better understand the concepts behind xLOBs and how to implement them in the class-rooms and facilitate learning with them.



Figure 4.2: Photo from the xLOBs Capacity Development Program

4.3.7. Career Guidance Capacity Development Program

The capacity-building program was designed for Makani Centers’ facilitators on how to use and implement the Career Guidance xLOBs. A 3-day workshop was conducted between the 17th and the 19th of June 2018. Eighteen (18) facilitators participated in the training.

The training workshop included training on the facilitation techniques, methods and skills for implementing the xLOBs, the participants were asked to do micro training: each facilitator chose an xLOB and presented it to the group and received feedback from the trainers and the other facilitators on the content, the pedagogy and the facilitation techniques.

Note: The capacity development component for the career guidance facilitators focused on mentorship. It was noted that the Makani center facilitator have received several training programs on many of the other areas considered in the initial design and the focus group meetings – but limited training on entrepreneurship. As such, it was agreed that the xLOB training for the facilitators would emphasize entrepreneurship, because entrepreneurship was identified as one of the most important skills to develop and bring out for people in crisis – in particular refugees. Such skills could prove invaluable irrespective of wherever they are: Whether still refugees in foreign countries having to be creative and entrepreneurial to survive, or whether they go back to their own country trying to rebuild their lives and their countries. Entrepreneurship was not only emphasized from a business perspective, but also from a social perspective – where young people serving their community, whether as refugees or at home, would require creativity

and entrepreneurship to deal with the expected hardship and difficult environments they are expected to encounter.

4.3.8. Orientation Session

The Center for Continuing Education organized an orientation session on the 14th of August 2018 targeting the directors of the selected Makani Centers, to provide them with more in-depth knowledge about the project and the capabilities xLOBs bring to their centers. Leadership buy-in and understanding will facilitate the work of the facilitators and their work with the children and provide them with the required support.

4.3.9. Pedagogical Support

The activity was carried out on the 13th to 15th of August; a support team from BZU consisting of xLOB designers and master trainers attended classes for facilitators in Math, Science and Career Guidance at the selected Makani center in Amman, and it was followed by a feedback session with the facilitators. The support team attended – two science classes, two math classes and three career guidance classes. CCE is committed to provide further support to counselors after the project ends.

4.4. Findings and Analysis

4.4.1. Focus Groups

Due to logistical and implementation constraints, the project team could not conduct all the planned focus groups, and had to combine these in two focus groups for facilitators and one for students. In total, 19 facilitators and 32 students participated in the focus groups. Table 4.1 presents the distribution of these groups:

	Specialization			Gender		Experience		
	Science	Math	Life Skills	Male	Female	< 5y	5-10	>10
Facilitators	6	5	8	3	16	15	3	1
Students	4	13	15	11	21			

Table 4.1: Focus Group Statistics

Key findings from the facilitator focus groups can be summarized as follows:

- **Expectations of digital/technology component:** Facilitators reported misalignment between their expectations about the nature of xLOBs and what they actually were. 60% of facilitators mentioned that they thought xLOBs are digital learning objects and/or incorporate a significant aspect of technology. Only a small minority stated that they expected the xLOBs to incorporate a new strategy and approach to impact change in learning.
- **Facilitators appreciated the new learning approach afforded by the xLOBs:** Facilitators thought that the xLOBs approach is learner-centric and integrates several dimensions of knowledge. It also focuses on life skills like collaboration, team work and planning.
- **Life skills facilitators were not clear on what the xLOBs entail:** Facilitators expected some aspects of digital learning to be incorporated in the program, which proved not to be the case. They also stated that they believe there still is a disconnect between life skills and education, and that the content is more suitable to older students.
- **Content of science and math xLOBs is distinctive and integrated:** Facilitators positively assessed the content of the science and math xLOBs, praising their innovative and structured approach and the variety of activities they incorporate.

- **Content of life skills xLOBs is very good and detailed:** Facilitators reported that the content of the life skills xLOBs was rich and detailed, and offered a variety of activities and exercises to choose from.
- **Content of xLOBs may not be appropriate for the target age groups:** Some facilitators mentioned that the content of some xLOBs was not suitable for younger students and would be more appropriate for older ages because of the complexity of the concepts they included. More significantly, most facilitators stated that the content of life skills xLOBs was more appropriate for youth (18-24 years) and that these xLOBs included difficult terminology and lengthy activities.

Key findings from the students' focus groups can be summarized as follows:

- **Learning through the life skills xLOBs was fun and interesting:** Students reported that the life skills xLOBs provided fun activities and helped them in their daily life, and that learning through these activities helped them understand the content better and faster.
- **The xLOBs required more time than the available sessions:** Students mentioned that the length of the available learning sessions was not sufficient to complete the activities in the xLOBs.
- **Learning through the science and maths xLOBs facilitated sharing of information and team work:** Students appreciated the team-based and peer learning design of activities. Although students first struggled to work in teams and groups, they managed to work together towards a shared objective.
- **Limited change in the facilitator's approach:** Almost half the students reported that there was no change in the approaches used by the facilitators during their delivery, while others noticed changes that varied between sessions.
- **xLOBs made the subject more attractive to students:** Students stated that the xLOBs are a new and attractive approach to learn and helps them think deeply about the topics they are introduced.

4.4.2. Facilitator Questionnaire

The facilitators' questionnaire asked about the impact of the xLOBs on the educational practices adopted by the facilitators. The findings can be summarized as follows:

- Adopting xLOBs strengthened the facilitator's understanding of student needs, allowed the facilitator to diversify their approaches and methods, and improved communication between the facilitators and their students.
- Using xLOBs enabled facilitators' to better understand the individual differences between students.
- The xLOBs strengthened the students' understanding of the subject matter, stimulated their interest and desire to learn, and facilitates team work and peer to peer learning.
- Students became more engaged in the learning process and more willing to express their opinions. Students also engaged in higher levels of discussion and conversation, and conceived innovative ideas and solutions.
- Some facilitators noted that using xLOBs did not help them complete their tasks faster or better achieve their objectives.
- Facilitators acquired new learning approaches and strategies that integrates different dimensions of knowledge, and were able to reflect on their methods and improve their delivery.

- Facilitators who used the life skills xLOBs mentioned that they acquired new skills and experiences, and helped them better manage their time and organize their work.
- Activities and content of xLOBs need to be simplified to become more suitable for the target groups.
- The time required to implement the activities in the xLOB (3 hours) was long and caused exhaustion among students, and students bored during some items that were outside their area of interest or not suitable to their age.

4.5. Synthesis of Findings

4.5.1. Key Challenges

Based on the responses of facilitators and students in the focus groups and questionnaire, the following challenges were identified:

1. **Target age groups** were not suitable matched with the xLOBs content. Several activities and content required higher levels of skill or knowledge and could not be properly executed by the students.
2. **Time allocation** of xLOBs activities was inappropriate. Most xLOBs required significantly longer time than the allocated session.
3. **Alignment with official curriculum:** The facilitators are required to complete the official curriculum, with which the xLOBs were not fully aligned.
4. **Some key skills were missing** from the life skills xLOBs, including communication and interpersonal skills, problem solving and critical thinking.
5. **Complex terminology** is used in some xLOBs, making them inaccessible to their target age group.

4.5.2. Findings and Recommendations

Despite the limited time period available for project implementation, there were several indicators that the xLOBs approach to learning have significant potential to improve learning and support teachers enrich their teaching and delivery.

- The largest proportion of the project was dedicated to the needs assessment, design and development of the xLOBs (65 xLOBs for science and math and 30 for life skills were developed). This left limited time for the training of facilitators and for implementing and evaluating the adoption of xLOBs in the classrooms.
- Despite the initial plan to integrate technology in the design of the xLOBs, a technology-constrained approach was adopted, resulting in xLOBs that has a limited technology component. This was considered by the project team to be the appropriate course of action given the outcomes of the needs assessment and the circumstances in which the xLOBs will be implemented.
- The xLOBs were considered by facilitators to offer a learner-centric approach that integrates several dimensions of knowledge, and focus on like skills like collaboration, team work and planning. Facilitators also appreciated the xLOBs innovative and structured design, and the variety of activities they incorporate.

Based on the findings from the project implementation, the following recommendations are made to help achieve the full potential of xLOBs in transforming learning at scale:

- **Improve matching of content and its target age groups:** xLOBs should be designed to be better aligned with their target age groups. Careful consideration should be taken to the knowledge, skill and capability levels of the target age group so that students can easily engage with and execute the activities and content in the xLOBs.
- **Allow higher flexibility for facilitators to adapt the xLOBs:** By making xLOBs extensible and adaptable, facilitators will be able to change and improve the content of the xLOB depending on the circumstances in the classroom and the dynamics of student engagement.
- **Develop xLOBs for younger learners:** New xLOBs targeting the youngest learners will introduce the xLOBs approach to learners at a younger age, and will help them to start building their skills and knowledge.
- **Align xLOBs with the official curriculum:** Aligning with the official curriculum facilitates the adoption of xLOBs at scale and leverages teachers' and facilitators' time and energy. This can be achieved in two ways: align the content of existing xLOBs with the official curriculum, or develop xLOBs for the curriculum itself.
- **Clarify activities in xLOBs:** Ensure that activities in xLOBs are clearly explained and include detailed instructions for execution.
- **Reduce the time required for each xLOB:** Re-design of xLOBs so that they fit the time available for them in the classroom.

4.5.3. Limitations

The project implementation faced several challenges and limitations that affected its outcomes and results. Most notably, the short period available for project implementation severely limited the ability of facilitators to test the use of several xLOBs. Many facilitators could not implement more than 2 xLOBs. Additionally, some participating centres did not serve the target groups intended by the xLOBs. This resulted in xLOBs being used for younger students, causing challenges in understanding of content and exercises.

4.6. Project Sustainability and Scaling

The xLOBs model is heavily focused on providing xLOBs as self-contained units of content that can be easily used by teachers and facilitators to improve their teaching and make it more learner-centric. The xLOBs development process is extensive and tedious. Leveraging all the xLOBs developed during the project implementation is critically important both for the sustainability of the project and for scaling it beyond its initial audience. For this purpose, the DLI team at Birzeit University and Birzeit's Centre for Continuing Education decided to release all xLOBs content they developed under an open and permissible Creative Commons license. This will facilitate the adoption of xLOBs at a large scale and make it accessible to the largest audience possible. For the purpose of disseminating the open licensed xLOBs, Birzeit's Centre for Continuing Education created a special online platform for hosting all the xLOBs developed by the centre, including those developed as part of the project implementation.

In addition to making the xLOBs open and available on the online platform, it is important to consider the necessary promotion and outreach activities to increase awareness about xLOBs and stimulate their adoption. An interesting feature of the Creative Commons license is that it enables the translation of licensed content into other languages, which would give a significant boost to the project's impact and

scale if the project team succeeds in attracting interested parties willing to translate the xLOBs into other languages and contexts.

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